FOREST PRODUCTS
Project Fact Sheet

PRODUCING A TRUE LIGNIN DEPOLYMERASE FOR BIOBLEACHING SOFTWOOD KRAFT PULP

BENEFITS

- Achievement of acceptable levels of product brightness without the use of chlorine
- Reduction of the kappa number of softwood pulp by significantly more than 50 percent

APPLICATIONS

The availability of an alternative method of bleaching kraft pulp will be important to industry in achieving environmental standards related to its bleach plant filtrates. Biobleaching may achieve acceptable levels of brightness for kraft pulps through a bleaching sequence that completely eliminates the use of chloride.

Direct "Biobleaching" of Softwood Kraft Pulp Can Eliminate Industry's Dependence on Chlorine

Industry is sensitive to the environmental concerns related to the large volume of chlorine and chlorine compounds traditionally used to bleach kraft pulp. The use of natural enzymes capable of degrading lignin would be a direct method for replacing chlorine in pulp and paper processing.

White-rot fungi are known to produce such enzymes and have been investigated as potential "biobleaching" agents to directly remove the lignin from kraft pulp. An enzyme isolated from the fungus Trametes cingulata was shown to completely depolymerize the lignin components of softwood kraft lignin, reducing the kappa number of the pulp brownstock by as much as 50 percent during a single treatment. However, the depolymerase activity naturally expressed by T. cingulata is low, and investigators believe that superior degradation of lignin will be achieved by genetically engineering the production of lignin depolymerase for this purpose.

OFFICE OF INDUSTRIAL TECHNOLOGIES
ENERGY EFFICIENCY AND RENEWABLE ENERGY • U.S. DEPARTMENT OF ENERGY

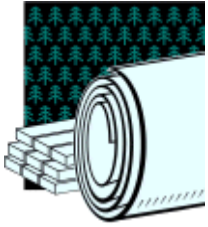
PROJECT DESCRIPTION

Goal: To genetically engineer an efficient method for producing lignin depolymerase and to incorporate this enzyme into an effective kraft pulp biobleaching sequence involving lignin depolymerase, alkaline extraction, and peroxide stages alone.

Both the genomic and cDNA libraries for the white-rot fungus will be constructed, analyzed, and appropriated. Full-length cDNA clones will be constructed and subcloned into secondary expression vectors (insect and yeast cells) capable of expressing functional lignin depolymerase. The purified recombinant protein for lignin depolymerase will be tested on the laboratory scale for use as a bleaching agent for softwood kraft pulp.

PROGRESS & MILESTONES

- Isolate and characterize the gene for lignin depolymerase from Trametes cingulata
- Incorporate the DNA code for the gene into suitable host organisms
- Optimize conditions ofr biobleaching softwood kraft pulp with recombinant lignin depolymerase



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